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PINE MORTALITY IN THE SOBOBA PENNY PINES PLANTATION, SAN JACINTO RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

The California five-spined ips, Ips paraconfusus, killed Coulter pines and Monterey x knobcone pines in a small plantation on the San Jacinto Ranger District, San Bernardino National Forest. The Monterey x knobcone cross appeared more susceptible than Coulter pine. Drought stress and the availability of late winter slash as breeding habitat were largely responsible.

INTRODUCTION

The Soboba Penny Pines Plantation was established along Highway 243 in order to restore some of the aesthetic values lost in the Soboba Burn. Recent tree mortality was cause for concern and the site was included among several evaluations recently conducted on the San Bernardino National Forest by personnel of Forest Pest Management.

On October 31, Susan Frankel, plant pathologist, and I accompanied Ernest Del Rio, silviculturist on the San Bernardino National Forest, and Kathy Valenzuela, resource officer on the San Jacinto Ranger District, to the plantation to evaluate the extent and causes of the mortality.

OBSERVATIONS

The Soboba Penny Pines Plantation consists of two parcels of about three acres each. The parcels are separated by an unplanted, brushy drainage less than 1/4 mile across and are surrounded by woodland chaparral vegetation that recurred following the fire. The site was planted in 1977 and replanted in 1978 after dozer site preparation. Jeffrey pine, Coulter pine and Monterey x knobcone pines were planted, but only the latter two species are present. Basal area is

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in the range of 25 to 30 sq. ft., heights are 10 to 30 ft., diameters vary from 2 to 10 inches dbh, stocking ranges from 200 to 300 stems per acre. Aspect is generally west to southwest. Competing vegetation is primarily manzanita (Arctostaphylos pringlei), whitethorn (Ceanothus leucodermis) and the shrubby form of interior live oak, Quercus wislizenii var. frutescens.

In spite of the competition and low site quality, growth has been good, particularly for the Monterey x knobcone cross. This necessitated a recent thinning to a spacing of 16 x 16 ft. The northern parcel was thinned in October/November, 1987. The southern parcel was thinned in February/March, 1988. This is the parcel in which tree mortality has occurred. Approximately 80% of the mortality is in the Monterey x knobcone cross, with Coulter pine comprising the remainder. In each parcel the slash was hand-piled into small mounds that were often partially shaded during part of the day. Most of the slash material was less than 2 inches in diameter, but almost every pile examined had a much larger bolt within its interior. These bolts had been attacked in the southern parcel and engraver exit holes were present. The number of beetles exiting this small amount of material could not have been large, but was apparently sufficient to initiate successful attacks in adjacent trees.

DISCUSSION

The relationship between the creation of slash and ensuing pine engraver populations capable of damage is fraught with unpredictability. Dolph (1971) states it clearly. "There are years when no trees are killed despite suitable slash and lots of beetles. These same conditions in other years lead to unacceptable tree mortality. Therefore, it is best to follow recommended practices and not to grow complacent because one has 'lucked out' for a couple of years."

Dolph notes that the critical factor appears to be the vigor of residual green trees in late summer. This in turn is related to spring precipitation. Normal or greater precipitation is generally correlated with no mortality. On the other hand, "ips years" occur when the winter is abnormally dry, warm weather lasts late into the preceeding fall and occurs early in the spring, and spring rains are few with long periods between what rains occur. These same general conditions appear appropriate to southern California, although tree vigor may well be stressed by mid-July in our Mediterranean climate.

The situation at Soboba is almost a textbook example of the relationship between pine engravers and slash manipulation. The northern half of the plantation, in which slash was created in October/November, did not incur any tree mortality. The southern half of the plantation, in which slash was created in February/March, incurred significant mortality. The slash created in late winter apparently was fresh enough to support progeny of the spring flight of parent adults. The F1 generation then emerged just when the trees were coming under moisture stress accelerated by two years of subnormal precipitation. The result was a population of ips sufficient to successfully attack the pines when their ability to resist attack was greatly reduced.

The number of Monterey x knobcone pines killed was much greater than the number of Coulter pines. This may have been the result of greater susceptibility to

moisture stress or the cross may be a more favorable host for ips than Coulter under similar environmental conditions.

MANAGEMENT ALTERNATIVES

1. No Action.

Thinning has already taken place and further green tree removals are not anticipated. Therefore, the pine engravers will not be breeding in green slash. Emergence from standing infested trees is a possibility however. Should these infested trees not be removed and the brood destroyed, mortality could continue in the plantation. Much depends on the return to normal precipitation levels at this harsh site.

2. Survey.

The plantation could be surveyed to determine how many, if any, currently infested trees occur in the plantation. This means examining green trees or trees just beginning to fade. Those trees that were red at the time of our site visit will not contain beetles for they will have long previously departed their host. Boring dust caught in the cracks of the bark and off-color foliage will be the major clues. Such surveys are not easy during the winter rainy season because the dust is washed from the bark.

It might be wise to delay any survey until just prior to beetle emergence in order to have all infested trees faded to some degree. This means finding an infested tree and periodically monitoring the development of the brood. Those infested trees located prior to emergence could then be cut and slashed, and the slash could be treated in one or more of the ways described in heading 3.

3. Prompt Slash Disposal and Treatments

Disposal	Treatment
-- Chipping	-- Plastic "Greenhouse"
-- Burning	-- Limbing
-- Removal	-- Lop and scatter
-- Burying	

Dozer trampling (crushing) and disking and trampling (chopping) are not practical on these small parcels at the present stocking, but might be an applicable technique on other sites. Chipping is the most thorough means of destroying slash, but the site must be accessible to the necessary equipment. Burning could be used to destroy those trees whose winter fading indicates that brood might currently reside beneath the bark. Burning fresh slash would destroy breeding material of small diameter. This could be done at Soboba if care was taken to avoid damaging leave trees. Slash can be removed from the host type and abundant open shrub types exist at lower elevations near the plantation. Slash can also be buried, but the depth must be adequate to ensure that the beetles do not find it. Covering the small slash piles with clear plastic sheeting is practical because the weather in southern California is such that temperatures lethal to beetle larvae are usually reached within these covered piles before the broods mature. Limbing is effective in removing the shade of foliage from above felled trees and the upper bole becomes less

favorable for the beetles. However, this is not as effective as limbing and bucking in drying out host materials.

When slash disposal is impractical, lopping and scattering the slash into openings where it is exposed to direct sunlight dries it out faster. Dry slash is unsuitable for beetle development.

4. Green Chain Technique

"When beetle populations in slash constitute a threat, the creation of a continuous fresh supply of slash during the flight period of the emerging adults will generally attract the beetles and keep them out of the standing green trees.....The slash should be created just as the beetles enter the pupal stage. Once this technique is started, it should be continued for each generation of that season" (Livingston 1979).

This technique has been used successfully in the inland Pacific Northwest. However, it takes a great deal of coordination, constant monitoring and flexibility in the availability of crews doing the thinning. With the number of engraver generations in southern California, small parcels such as Soboba might not have sufficient "remove" trees to last the entire season of beetle activity. The large number of beetle generations also makes the number of entries large. This could be cumbersome and demanding of personnel time better directed elsewhere. It is manditory that slash does not touch leave trees, and it is preferable that any slash be a foot or two away from the bole.

5. Treat Slash or Leave Trees with Insecticide

Sevin 80S and 50W are registered insecticides for preventing successful bark beetle attack upon standing trees. The lower branches of many trees in the plantation have a dense, bushy nature that would make some trees difficult to spray. This is particularly true of the Monterey x knobcone cross. However, with a little persistance, the boles up to 10 ft could be treated with a backpack sprayer. This would still leave many trees subject to top-kill.

SUMMARY

Under conditions similiar to those at Soboba Penny Pines, lopping all slash and exposing it to the sun appears the most feasible approach. Only a small portion of the slash was capable of producing a succeeding generation of ips. In summary:

Slash Treatment

	Method	Expected Results
BEST	- All lopped and exposed to sun	< no. of beetles produced
|	- Only vertical branches limbed	|
|	- Unlimbed	|
WORST	- Lopped and piled	> no. of beetles produced

Worst time to create slash -- January to mid-July
Best time to create slash -- August to December

These and other management practices are given in the appendices. Under a given combination of goals and objectives and site conditions, one or more of these may be utilized whenever ips problems are anticipated or occur on the district.

LITERATURE CITED

Dolph, R. E. 1971. Oregon pine ips infestation from red slash to green trees. In D. M. Baumgartner (ed.), Precommercial thinning of coatal and intermountain forests in the Pacific Northwest, p. 53-62. Washington State Univ., Pullman, WA.

Livingston, R. L. 1979. The pine engraver beetle in Idaho: Life history, habits and management recommendations. Idaho Dept. Lands Rept. 79-3. 7 p.

APPENDIX I

BEST PRACTICES FOR MANAGING SLASH AND IPS

-- Surveillance (monitoring) - no treatment is necessary if there are few beetles.
  -- reddish boring dust on upper surfaces and on ground under slash
  -- Y, I, or H-shaped egg galleries; Y-shaped most common
  -- no pitch tubes
-- Keep track of the amount of slash laid down by windstorms.
-- Salvage windthrows as soon as possible.
-- Check lightning struck trees whenever a fresh strike is seen.
-- When practical, cut young-growth pine after mid-July.
-- Lop and scatter all slash -- expose main stem to sun.
-- Utilize to minimum top diameter when practicable.
-- Keep accumulations of slash or green logs away from living trees, and fell trees away from dense thickets of young-growth.
-- Prevent accumulation of felled material (avoid cutting practices and patterns conducive to windthrow).
-- Log infested and threatened stands, first prioirty: stands with heavy populations and/or large volumes per acre.
-- Remove dead and infested trees from campgrounds before emergence of beetles.
-- Residue treatments to minimize damage is most effective if applied before the thinning slash is attacked.
-- In high risk areas, such as campgrounds, use method(s) that prevent aggregation of many attacking beetles in proximity to residual trees.
-- Avoid trimming along power lines and other rights-of-way, running logging equipment over root systems of residual trees (designate skid trails), or other practices which may injure trees during periods of hot dry weather.
-- Destroy slabs from portable sawmills operating in forested areas.
-- Do not leave any ponderosa pine slash in a position that will prevent it from drying out quickly. When slash must be piled, plan to do it after mid-October, or treat by chipping or some other destructive method.
-- Intensive utilization and clean logging - eleminate much of the slash and make it possible to more efficiently and effectively treat the slash in fuel and insect management.
-- Slash piled or bunched for burning or for wildlife habitat should be allowed to dry before the piling operation.
-- Alternate stand structure and species composition to reduce susceptibility.
-- When necessary, kill broods by best means.

APPENDIX II

AVOID THESE WORST MANAGEMENT PRACTICES

-- Allowing stagnated or highly competitive growth conditions in stands.
-- Piling fresh slash in any season without further treatment.
-- Letting slash or green logs accumulate near living trees.
-- Piling bucked limbs and cull logs along any forested roadside for fuelwood without prior treatment.
-- Windrowing fresh slash without drying (or partial drying).
-- Sporadic cutting in the spring of the year, with the slash unlopped and unscattered.
-- Removal of infested material to developed areas where emerging beetles can attack high value trees that may be stressed by improper site manipulations.
-- Piecemeal treatments - measures to suppress beetle populations in thinning residues will minimize damage only if applied comprehensively on a regular basis.
-- Piling fresh slash adjacent to standing trees.

APPENDIX III

PREVENTIVE MEASURES FOR MINIMIZING TREE MORTALITY[1]

1. "Thinned, vigorous stands are less attractive to engraver beetle attack, particularly during drought years. However, recently thinned stands may temporarily be more attractive until the trees increase their vigor.

2. "Slash should be minimized or not created during the months of January through June. If the beetles do not have fresh slash in the spring, the population dies down.

3. "The optimum time period for management activity where slash will be created is late August to December. Activity either earlier or especially later than this increases the potential for subsequent tree killing.

4. "When it is not practical to avoid creating slash in the high risk months of January through June, several management practices can be used to help minimize the potential impact:

   a. "Prompt slash disposal: Dozer trampling of slash is apparently effective in reducing the volume of breeding material; chipping is also very effective and especially useful in developed areas. When slash is burned, avoid scorching standing trees as this makes them very attractive to numerous species of wood-boring insects.

   b. "Where general slash disposal is impractical, scattering the slash into openings where it is exposed to direct sunlight dries it out faster, thus making it unsuitable for beetle development.

5. "When beetle populations in slash constitute a threat, the creation of a continuous fresh supply of slash during the flight period of the emerging adults will generally attract the beetles keeping them out of the standing green trees. This technique is known as providing a **green chain**. The slash should be created just as the beetles enter the pupal stage. Once this technique is started, it should be continued for each generation of that season.

6. "Logging operations can create many problems that lead to excessive killing of residual trees. Methods that may help reduce the risk are:

   a. "Trees whose roots are exposed or disturbed or that have large patches of bark knocked off should be cut and removed.

   b. "Fall trees into openings and use established skid trails to avoid damaging the residual stand.

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1. Livingston, L. R. 1979. The pine engraver beetle in Idaho: Life history, habits and management recommendations. Idaho Dept. Lands Rept. 79-3. 7 p.

7. "In housing developments avoid disturbing the roots of trees that are to be left as ornamentals as these will often be weakened and attacked. Weakened or badly damaged trees should be removed prior to completion of construction. Slash created by housing developments should be disposed of as soon as possible. It should not be left near ornamental trees as attacking beetles often overflow the slash and infest leave trees.

   "Avoid back-filling over root areas. Four inches or more of dirt over the roots often stresses the trees making them attractive to attacking beetles.

8. "When trees are cut for firewood, posts or logs, do not stack the fresh pieces against standing green trees. Beetles that develop in the bolts or logs tend to crawl to the standing tree to make their attack. Snags or dead wood that is dry and has loose bark will not support beetle development."